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(54) IMPROVEMENTS IN OR RELATING TO PNEUMATIC TYRES

- (71) We, THE DUNLOP COMPANY LIMITED (formerly Dunlop Rubber Company Limited) a British Company of Dunlop House, Ryder Street, St. James's, London S.W.1, (formerly of 1 Albany Street, London, N.W.1), do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—
- This invention relates to a method of manufacturing a pneumatic tyre. More particularly, the invention relates to a method of manufacturing a pneumatic tyre suitable for use on the road wheels of heavy trucks, tractors or earthmover vehicles, wherein the tread portion of the tyre is provided on its ground-contacting surface with a pronounced tread pattern such as a plurality of traction bars.
- During the moulding process a pattern is produced in the radially-outer surface of the tread portion by a suitably patterned inner moulding surface of the mould. The uncured elastomeric material of the tread portion is pressed into contact with, and to some extent flows into, the patterns on the mould surface during cure to provide the desired final tread surface pattern. This flow of the tread portion material carries the radially-outermost casing layers, such as the breaker layer cord material, radially outwardly to follow the profile of the moulding surface pattern.
- This displacement of the casing cord material is quite pronounced when tyres such as tractor and earthmover tyres having traction bars are being moulded since the tread portion material flows to a considerable extent during moulding thereby also displacing the casing cord material to a comparatively large degree during the moulding operation.
- It is an object of the present invention to provide a new or improved method of manufacturing a pneumatic tyre which will obviate the above disadvantages.
- In accordance with the invention there is provided a method of manufacturing a pneumatic tyre comprising building a tyre casing
- of uncured rubberised cord material with or without an uncured tread portion of elastomeric material, moulding the casing to substantially its desired final configuration and at least partially curing the casing, applying an uncured tread portion of elastomeric material to the moulded and at least partially cured casing except when said tread portion already is built onto the casing and curing and moulding the uncured tread portion upon the at least partially cured casing.
- Preferably the casing is maintained in contact with a heat conducting member, during the curing and moulding of the tread portion, at a temperature lower than the temperature of cure of the tread portion thereby substantially to prevent over-cure of the casing. It is to be understood that the term "casing" is deemed to refer to all the constituent parts of the tyre with the exception of the tread portion, and including the carcass plies, liner, breaker layers, sidewall rubbers, beads and fillers.
- In one method according to the invention the radially-outer surface of the at least partially cured casing is roughened by a rasping or buffing operation before the tread portion is applied thereto. The tread portion conveniently is applied to the casing by enclosing the moulded and at least partially cured casing between substantially parallel side members, applying the tread portion to the radially-outer surface of the casing in between said members and curing and moulding the tread portion between said members and a plurality of movable moulding segments applied to the radially-outer surface of the tread portion.
- In an alternative method, also according to the invention, the completely-built, uncured tyre is cured in two stages. In the first stage the casing of the uncured tyre is at least partially cured by heating it in a mould which has a smooth contour in the tread region i.e. no tread pattern is imparted to the tyre. In the second stage, which may conveniently be carried out in a tread curing ring of the type used for retreading tyres

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which is provided with a tread-pattern moulding matrix, the tread and, if necessary the partially cured casing, are heated to completely cure the whole tyre. Overcure of parts of the tyre may be prevented by cooling the tread region during the first stage and/or cooling the casing during the second, and one convenient method of cooling comprises passing cooling fluid, e.g. cold water or air, through a suitably-shaped heat conducting member held in contact with the appropriate part or parts of the tyre, the member thereby being maintained at a temperature lower than the cure temperature.

Also in accordance with the invention there is provided a pneumatic tyre produced by one of the methods as described in the four preceding paragraphs.

One embodiment of the invention will now be described in more detail by way of example.

In this embodiment the method, according to the invention, is utilised to produce a rear tyre for a tractor, wherein it is desired to mould a traction pattern on the ground-contacting surface of the tyre, said pattern comprising a plurality of chevron traction bars.

The casing of the tyre is built in conventional manner upon a tyre building former in cylindrical form and comprises the usual beads, fillers, carcass plies, breaker layers and sidewall rubbers. The casing is then removed from the former and placed in a curing and moulding press to mould the casing substantially to its desired final configuration and also to partially cure the casing. When this stage of the method is complete, the casing, in its partially cured state, is in its desired toroidal form and the radially-outer surface of the casing is substantially cylindrical and is provided with a plain smooth finish. This radially-outer cylindrical surface of the casing is then roughened by applying a buffing wheel thereto and the casing is then positioned between two rigid parallel side plates of the type commonly used in retreading processes. A preformed unvulcanised tread portion is then applied to the radially-outer surface of the carcass in between said parallel side plates.

The tread portion is moulded and cured in position upon the partially cured casing by applying a plurality of radially movable moulding segments to the radially-outer surface of the tread portion, the moulding segments together forming an annulus, the radially-inner moulding surface of which defines the desired chevron pattern.

Heat and pressure are applied to the moulding segments and to the rigid side plates fully to cure the casing and also the tread portion, the desired tread surface pattern being moulded in the tread portion during the curing operation.

Since the casing is initially partially cured before the tread portion is applied thereto it

is important to ensure that the casing is not over-cured during the final curing step. In order to ensure that over-curing of the casing does not take place the casing is filled with a deformable bag containing fluid, such as cold water, before the curing of the tread portion takes place. The water-filled bag conducts heat away from the surface of the casing during cure of the tread portion thereby helping to maintain the temperature of the casing below the temperature of cure of the tread portion and thereby substantially prevent the possibility of over-cure of the casing.

The utilisation of the above described method prevents any distortion of the breaker layers or carcass plies of the casing during the moulding of the tread pattern in the tread portion. The resulting tyre is thus a more uniform product than tyres hitherto produced in which the moulding of the casing and tread portion has been carried out in a single operation.

WHAT WE CLAIM IS:—

1. A method of manufacturing a pneumatic tyre comprising building a tyre casing of uncured rubberised cord material with or without an uncured tread portion of elastomeric material, moulding the casing to substantially its desired final configuration and at least partially curing the casing, applying an uncured tread portion of elastomeric material to the moulded and at least partially cured casing except when said tread portion already is built onto the casing and curing and moulding the uncured tread portion upon the at least partially cured casing.

2. A method according to claim 1 wherein the radially-outer surface of the at least partially cured casing is roughened by a rasping or buffing operation before the tread portion is applied thereto.

3. A method according to claim 1 or 2 comprising enclosing the moulded and at least partially cured casing between substantially parallel side members, applying the tread portion to the radially-outer surface of the casing in between said members and curing and moulding the tread portion between said members and a plurality of movable moulding segments applied to the radially-outer surface of the tread portion.

4. A method according to claim 1 comprising heating the casing of an uncured tyre with tread applied in a mould which has a smooth contour in the tread region so that the casing is at least partially cured and no tread pattern is imparted to the tyre, removing the tyre from the mould, locating it in a tread curing ring having a tread-pattern moulding matrix thereon, and heating at least the tread of the tyre so as to obtain a completely-cured tyre.

5. A method according to any of the preceding claims wherein the tread is cooled during the heating and curing of the casing

- thereby substantially to prevent overcure of the tyre tread.
- 5 6. A method according to any of the preceding claims wherein the casing is cooled during the heating and curing of the tread thereby substantially to prevent overcure of the tyre casing.
- 10 7. A method according to claim 5 wherein the tread is maintained in contact with a heat-conducting member, during the curing of the casing, at a temperature lower than the temperature of cure of the casing.
- 15 8. A method according to claim 6 wherein the casing is maintained in contact with a heat conducting member, during the curing of the tread portion, at a temperature lower than the temperature of cure of the tread portion.
9. A method according to claim 7 or 8 comprising passing cooling fluid through the member.
- 20 10. A method according to claim 9 wherein the cooling fluid comprises cold water.
11. A method according to claim 9 wherein the cooling fluid comprises air.
- 25 12. A pneumatic tyre produced by a method as claimed in any of the preceding claims.
- R. I. G. McKAY,
Agent for the Applicants.

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